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THE MUSHROOM GROWERS'
ASSOCIATION

MGA
BULLETIN

SEPTEMBER 1960 · NUMBER 129

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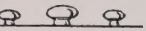

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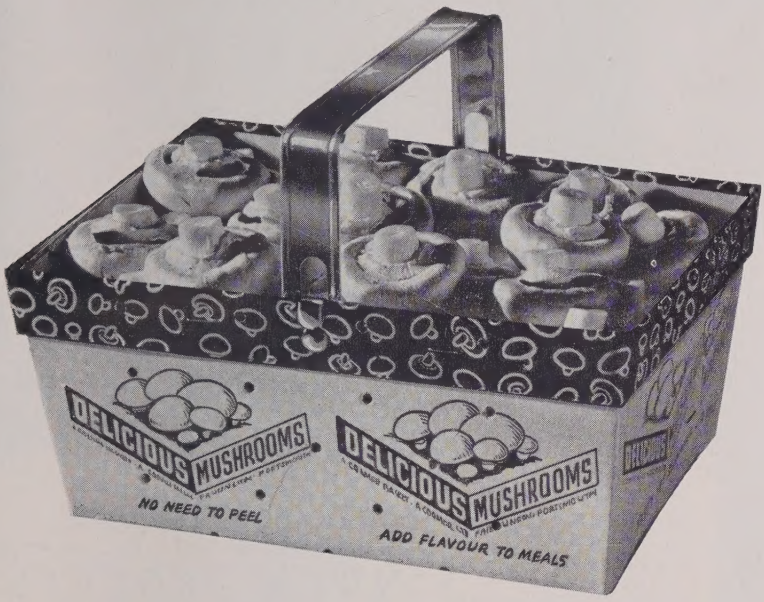

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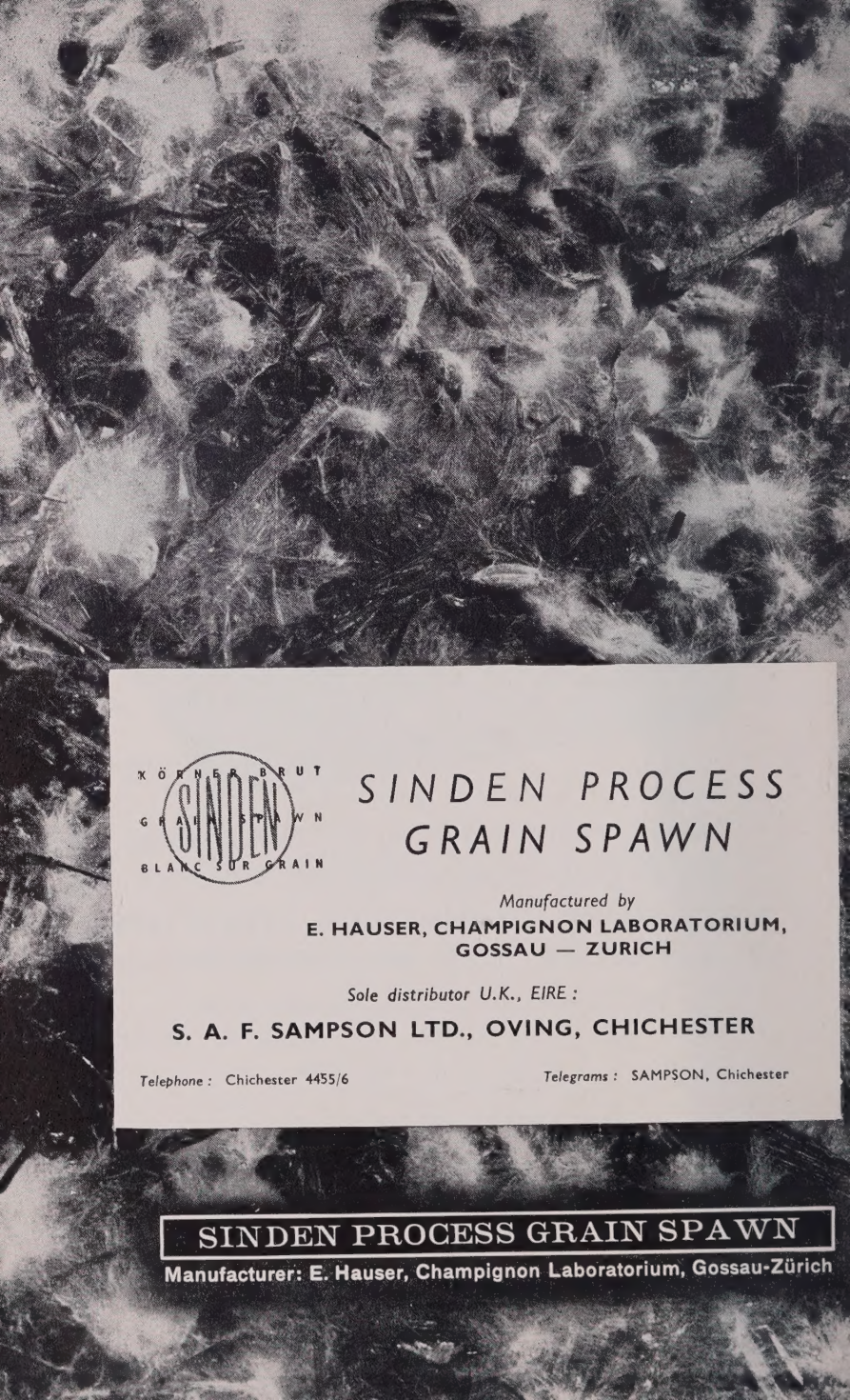

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EDITORIAL

COME TO WESTON-SUPER-MARE

To the rank and file of mushroom growers, Weston-Super-Mare, scene of the 1960 Mushroom Industry Conference, will no doubt offer special attraction in that the organising committee has deliberately laid emphasis on the practical rather than the scientific side of mushroom production.

It is true of course that it is through science, in this modern world, that real progress must come although, at the beginning of things no doubt, it was through practice that laboured advances were made.

Today the average grower is fully aware of the part played by the scientists, but it is in the practical application of their findings that he is anxious and willing to apply himself.

At Weston-Super-Mare he will have the opportunity, not only of listening to practical growers who may well have met and overcome problems which have themselves perplexed him over the years, but of taking part in the discussion which will inevitably follow each paper.

Too many mushroom growers, I think, live far too much in a world of their own and, commendable though this dedicated attitude may be, such growers may well remain too long too close to the job, too close perhaps to get their problems in true perspective.

Some, but certainly not all of the Conference papers, are being given by growers who have never before performed such a task—for task it certainly is as those more experienced will testify.

Come to Weston then in October, to listen and learn, to discuss and, by your attendance, to give thanks to those who, busy people no doubt in this busy world, have found time to prepare the papers and who have agreed to find further time to present these papers at the Conference, to answer specific questions and to take part in the discussions.

WRA

MUSHROOM GROWING IN HOLLAND

How the Research Station Helps

Some interesting facts and figures on mushroom production in Holland were given by Dr. P. J. Bels, Director of the Mushroom Research Station there, on the occasion of the recent visit to the station of a number of MGA members.

Dr. Bels, who pooh-poohed any idea that the Dutch growers were likely to invade the English market, at least for some considerable time, explained the financial set-up of the Station, the cost of which was about £32,000. It was officially opened in the summer of 1959.

The repayment of the initial loan and the interest is guaranteed by the Dutch Government. Of the 550 growers in Holland who, in 1959, produced an average of 10,500 lb. each, giving a total production of 5,500,000 lb., 350 only contribute to the Research Station, paying between them 25,000 guilders, or about £2,500.

Dr. Bels raised a laugh when, pointing to a map of Holland, he indicated that the non-contributing growers, the black sheep he said they were, were marked with black pins.

The Research Station is governed by a Board, consisting of seven growers nominated by growers and three nominated by the Ministry.

In the course of the first year growers submitted about 1,000 samples of compost, diseased mushrooms and so on, and the Station staff, numbering 11 in all, paid an average number of visits to growers of 100 each month.

The following table shows how the number of growers and total yearly production has risen over the last 17 years and average prices since 1954.

Year	No. of Growers	Annual Production	Average price in Guilders per kilo*
1943	23	154,000 lb.	
1947	30	330,000 lb.	
1948	55		
1950	—	550,000 lb.	
1952	60		
1954	—	1,430,000 lb.	2.83
1955	180		2.76
1956	—	2,860,000 lb.	3.02
1957	320	3,630,000 lb.	3.15
1958	470	5,000,000 lb.	2.35
1959	520	5,500,000 lb.	2.70

*kilo = 2.2 lb. Guilder = 1/11d. (approx.)

There is no organised publicity in Holland but consumption, still very low per head, is slowly increasing. It was 3 grams per head in 1940, rose to 1 oz. per head in 1950 and now stands at 3 oz. per head.

As in England the price tends to fluctuate according to supplies and, for first grade, may drop as low as two guilders a kilo and rise at other times to 5 guilders. During hot weather prices are at their lowest.

The Research Station organised mushroom growing courses in 16 different centres last year, and for the course at Maastricht for instance, there was a total attendance of 32, 16 coming from the Maastricht area and 16 from over the border in Belgium. The courses extend for ten evenings with a three-hour session each evening.

Mushroom production is centred on the small button type.

GLASSHOUSE CROPS RESEARCH INSTITUTE

Subscription Scheme

Growers who are interested in the work done on their behalf at the Glasshouse Crops Research Institute and who would like to support it in a modest way may like to have their attention drawn to the Institute's Subscription Scheme. For a small annual subscription (two guineas for growers working on their own account, five guineas for firms or companies) they may obtain certain privileges, and the balance of their subscription is largely available to meet desirable expenditure not covered by the Treasury grant made for the normal running of the Institute. In this way they can make a real contribution to the development of the Institute's work, which is becoming of increasing value to growers in many fields.

The privileges at present available to Subscribers are (1) to receive the Institute's Annual Report and (2) to visit the Institute on the annual Open Day, lunch and tea being provided. As the Institute's work develops it may be possible to confer additional privileges on Subscribers.

The Subscription Scheme is under the administration of the Institute's Governing Body, on which growers are represented, and further particulars may be obtained from :—

The Secretary,
Glasshouse Crops Research Institute,
Worthing Road,
Rustington, Littlehampton, Sussex,

or from The MGA Office, Agriculture House, Knightsbridge, London, S.W.1.

Book Review

THE NEW "BULLETIN 34"

This old " Mushroom Growers' Bible " has been completely re-written, and according to the Foreword " an attempt has been made to give a picture of the principles of good house design and growing practice without describing any particular specialist's methods". On the whole this attempt has been very successful.

The Bulletin gives a clear account of plain straightforward mushroom growing, covering buildings, heating and ventilation systems, composting, peak-heating, spawning, casing, management of watering and ventilation, picking, marketing, hygiene and control of pests and diseases.

There is no pretence at frills, and the really advanced grower who makes a point of keeping right up to date will not learn much from the book, nor indeed should he expect to. Anyone with less knowledge should find it useful and for the novice it is a very sound guide.

There are just a few criticisms. During peak-heating, one air change per day is advised, without specifying whether this is for a shelf house or a tray system heat room. I doubt whether it is quite enough for the former, and it certainly would not be for the latter. I also question the advice that " all cracks should be sealed with paper or plastic film, after which peak-heating can begin " in shelf houses. There probably are some houses with so many unstoppable air leaks that they still get enough air when this is done, but there must be many others where this advice taken literally would be most injurious.

Also on the subject of peak-heating I thought it was now recognised that growth of Olive Green Mould is due to lack of air (or excess of carbon dioxide) during peak-heating, rather than to " over peak-heating ".

The time in the stack for normal " long " composting is given as 4 to 5 weeks, and 5 lines later, as 20-28 days!

When re-writing the chapter on Manurial Value of Spent Compost the authors seem to have had all eyes glued on the risk that someone might some day blame them for damage to crops from insecticide residues, excess of lime or soluble salts in mushroom compost applied to land or in glasshouses. Their warnings are undoubtedly justified in substance, but they are so lengthy and emphatic that the modicum of praise which follows is rather lost. If mushroom compost is good enough to " compare favourably with other bulky organic manures ", which presumably means that it is rather better than the others, this salient fact might have been given first, with the " ifs and buts " to follow.

There are some omissions compared with previous editions ; the section on nutritive value and outdoor culture in pastures will hardly be mourned and the list of references to scientific papers was always rather highbrow for a work of this kind. An index, which was included in previous editions, is more useful, though it is not very difficult to find what one wants from the list of contents and a glance through the relevant chapter.

I understand that there has been much less delay between completion of the text and publication than there was with the last two editions, which is a great improvement.

On the whole, a very good Bulletin, and excellent value at 6/-.

R.L.E.

Bulletin 34 "*Mushroom Growing*" published by HMSO at 6/-

PUBLICITY MATERIAL AT HALF PRICE

In order to obtain a wider distribution of mushroom publicity material, supplies are now being offered at half the cost price. Full details of the prices and the material available are given on p. 328 of this issue.

WESTON CONFERENCE ARRANGEMENTS

Papers — Reception — Dance — Competitions

Apart from a few loose ends, the arrangements in connection with the Mushroom Industry Conference at Weston-Super-Mare, commencing with a " Get Together " on the evening of Monday, 10th October, and ending with the departures on the morning of Thursday, 13th October, are now pretty well complete and the organising committee is hoping for a bumper attendance of members.

Included elsewhere in this report to date is the complete programme together with a list of speakers and subjects. In due course all U.K. and Eire members of the Association will receive a special Application Form which should be completed and returned to the MGA Office not later than the specified date.

Members will appreciate that, in the organising and running of a conference on this scale, a considerable amount of expense is involved, the more so as, without an exhibition, there is no source of income. The Executive Committee of the MGA has therefore decided that a charge of 30/- per head should be made for each adult attending and this charge will cover all the events of the conference, including a copy of each conference paper wherever this is possible immediately after it has been read and discussed, entry to the Reception and Dance, the Golf Competition, Ladies Outing and so on. There will be no other official charges.

The money so raised will, it is hoped, defray all the major expenditure including the printing of the papers.

It is proposed that the complete set of conference papers should be made available to members not attending on payment of 30/-. The papers will however, be produced individually, with, it is hoped, the subsequent discussions, separately in successive issues of *The Bulletin* but about a year may elapse before the series is completed.

Will members please make a particular note to apply for the full conference ticket on the special application form which they will receive within the next few days.

Particular attention is drawn to the mushroom competitions **including a new class for 12 mushrooms on a plate.** It is hoped that as many members as possible will enter. This year the judging is expected to take less than half-an-hour as groups of three Grower Members who have not entered for the competitions, are to be asked to judge each class simultaneously. These awards, together with the Golf Bowl and the cheques to the winners of the window dressing competition, are all to be presented during an interval at the dance which follows the official reception given by the Mayor and Corporation of Weston-Super-Mare.

Publicity for mushrooms is not being overlooked and, in addition to the window dressing competition, a cooking demonstration is being arranged in co-operation with the local Area Gas Board.

All the major items on the programme will take place at The Grand Atlantic Hotel which is the MGA conference headquarters.

All the available accommodation has now been taken at this hotel. Each member should have received a Weston Hotel Accommodation List and members are advised to complete their bookings without further delay.

Programme and Schedule

of

Mushroom Industry Conference

to be held at

THE GRAND ATLANTIC HOTEL

WESTON-SUPER-MARE

on 10th, 11th and 12th October, 1960

PROGRAMME

	Monday, 10th October
9 p.m.	" Get Together ", The Grand Atlantic Hotel.
	Tuesday, 11th October
9.30 a.m.—11 a.m.	Lectures (2)
11 a.m.—11.15 a.m.	Break
11.15 a.m.	Official Welcome by Mayor of Weston-Super-Mare
11.30 a.m.—1 p.m.	Lectures (2)
1 p.m.	Lunch
2 p.m.—5.30 p.m.	Golf Competition
4.30 p.m.	Mushroom Competition Judging
	Wednesday, 12th October
9.30 a.m.—11 a.m.	Lectures (2)
11 a.m.—11.15 a.m.	Break
11.30 a.m.—1 p.m.	Lectures (2)
1 p.m.	Lunch
2.30 p.m.—3.15 p.m.	Lecture
3.15 p.m.—3.30 p.m.	Break
3.30 p.m.—5 p.m.	Lecture/General Discussion
8.30 p.m.	Reception and Dance given by Mayor and Corporation of Weston-Super-Mare. Dinner Jacket—Dark Lounge Suit.
9.30 p.m.—Midnight	Dancing
10.30 p.m.	Presentation of Awards
	Wednesday, 12th October
	Ladies' Coach Outing 10 a.m. to 4 p.m. Cheddar Gorge, Wells, etc.
	Thursday, 13th October
a.m.	Departures.

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Speakers and Subjects

V. L. Barrow, Esq., B.Sc.	*Composting by Analysis*
N. R. Cooper, Esq.	*Problems connected with a Small Farm*
R. Duthy, Esq.	*Twenty-five years of Mushroom Growing*
Dr. R. L. Edwards, Ph.D., B.Sc., F.R.I.C.	*Ventilation*
C. H. Fawcett, Esq., A.M.I.E.E.	*Mushroom Farm Heating*
Cooke D., Esq., P. B. Flegg, Esq., B.Sc., A.R.I.C. (G.C.R.I.)	*Harvesting Practices*
E. H. Gardener, Esq., C.B.E., (N.F.U.)	*Policy*
Graham Griffiths, Esq.	*Problems Connected with a Large Farm*
Dr. N. W. Hussey, Ph.D., B.Sc., & I. J. Wyatt, B.Sc., (G.C.R.I.)	*Some Economic Considerations in the Control of Mushroom Pests.*
Robt. Patterson, Esq., B.Sc. (Agric.)	*Whither Mushroom Growing?*
Prof. Dr. R. von Sengbush (*Director*, Max Planck Institut, Germany)	*Active Mycelium Spawning*

MUSHROOM CANNING IN SOMERSET?

Extension to other Foods refused

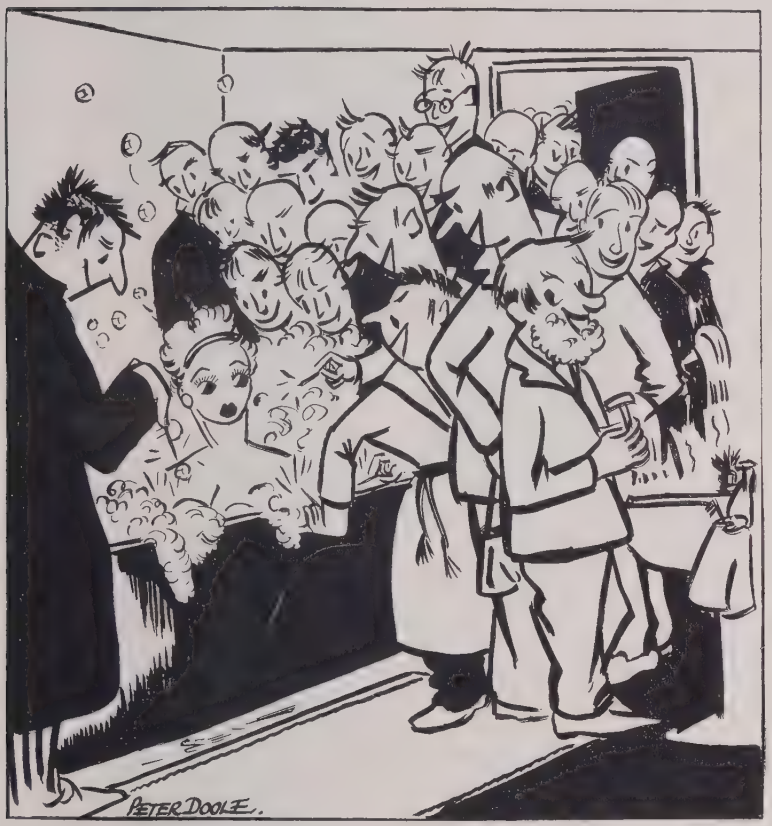
Whilst the Planning Authority has given permission for a mushroom canning factory on the application of Mr. Graham C. Griffiths of Wrington Vale Nurseries, Congresbury, Somerset, it has refused to extend this permission to include a range of products outside mushrooms.

The *Western Daily Press* of 1st August reported that Mr. Griffiths, who is Vice-Chariman of the MGA, was given permission to go ahead with his plans to establish a cannery for mushrooms, subject to a condition that the permit did not include the canning of other food-stuffs.

Subsequently Mr. Griffiths applied again, seeking the removal of the condition, leaving him free to combine mushroom canning with other foods such as steak, chicken etc.

At a meeting of the Axbridge Rural Council Mr. P. R. Packer of Cheddar asked if the application could not be met in some way, pointing out that otherwise expensive equipment might lie idle for periods. Mr. W. J. Silcocks, Chairman of the Committee concerned said " We may have a major canning factory producing Wrington's own 57 varieties " adding that if the applicant used a small variety of foodstuffs it might have been possible for the authorities to blink their eyes a little, but there was no safeguard if the condition was removed. Mr. W. H. Mitton said the business started with washing mushrooms, then, almost before the ink was dry came an application to can mushrooms and again before the ink was dry came this further application. " This place is in the green belt—surely the wrong place to start an enterprise like this?" he said.

WHAT, NO PRIVATE BATHROOMS?



The Brochure said *some* rooms, had very good views
And you could tell which *they* were, by the size of the queues.

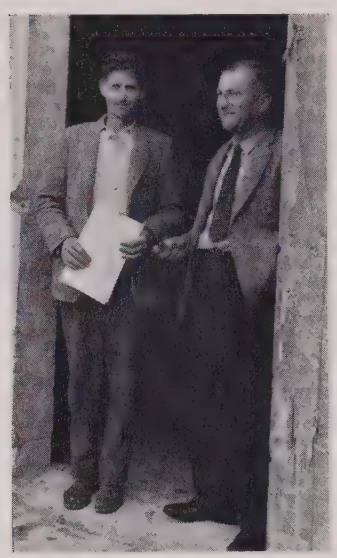
BY COACH TO WESTON-SUPER-MARE?

If you are thinking of going to the Weston-Super-Mare Conference in October and are undecided about transport, Mr. G. Hardwick of Northern Horticultural Supplies, Russell Street Chambers, Bingley, Yorks. (Bingley 4383) is endeavouring to organise a complete coach party, starting from Bingley on the morning of Monday, 10th October, travelling via Colne, Burnley, Accrington and Blackburn to Blackpool (2 p.m.) and thence via Preston, Hesketh Bank, Ormskirk, Southport, etc., before proceeding South, picking up on the way. Those interested should contact Mr. Hardwick immediately—he is also willing to arrange hotel accommodation.

My way of Growing **SUCCESSFUL GROWING—SUSSEX STYLE**

by "Onlooker"

One of the most productive smaller farms in Sussex must surely be that of Mr. D. F. Stay at Singleton. It is located on the main road about a mile north of the village on a hillside with eastern exposure. The present growing houses were originally part of the camp guarding the ammunition tunnels during World War II. Needless to say these have been considerably modified but do account for the reason why a farm of about 10,000 sq. ft. growing area is confined to three growing houses each of over 3,000 sq. ft. A purpose built conditioning/peak heat house has been added. The mushroom farm is part of a 230 acre mixed farm, so Mr. Stay has no problems about spent compost —he simply uses it all himself.



Mr. Jim Tunney - with record cards - and Mr. D. F. Stay

For the past four years the mushroom farm has been very ably managed by Mr. Jim Tunney and Mr. Stay gives him full credit for its success—and a farm with an average net yield on trays of about 3 lb. per sq. ft. and shipping 3,000 lb. of mushrooms per week is very successful. The last completed crop gave 3.1 lb. per sq. ft. in 46 picking days. His record cards show that a crop just pinning up for its third flush at the time of my visit had already yielded over 2 lb. per sq. ft. equivalent to—and this is perhaps more important—350 lb. per ton of stable manure used in the compost.

Insulation of the growing houses is done by means of multi-layers of fibre glass. The outside walls are whitewashed frequently and during the very hot summer of 1959, Mr. Tunney claims that this was responsible for a reduction of 10° F. in inside temperatures. For ventilation air is drawn into the houses through special filters and distributed through by ducting down the top centre of the houses. It is exhausted by ducts at floor level into external pipes which run up the outside wall to the eaves. These are clearly

Arrangement of trays in growing house. This is third flush pinning up, previous two flushes yielded over 2 lbs. per sq. ft. net

Shows whitewashed growing houses, with ventilation pipes from floor level ducts. In foreground reading left to right Mr. P. K. T. Low, Mr. Jim Tunney, Mr. E. A. Gook and Mr. D. F. Stay

shown on the photograph of the growing houses. The gross cubic air space to growing area ratio is approximately 4 : 1.

The peak-heat house is built with hollow concrete blocks. To improve insulation the inside walls are covered with Foliac. The ceiling is painted hard board supporting eight layers of fibre glass. Air movement is effected by electric fan, the blades of which are inside ducting within the house but the motor drive is located outside. The air is blown out through ducting at ceiling height returning through ducting at floor level on the same wall. To take care of condensation from the roof and keep the fibre glass dry there are special ventilation ducts in the air space between them.

The average weekly lay down is about 1,000 sq. ft. but owing to the size of the houses filling of over 3,000 sq. ft. is done each three weeks, making 17 crops a year. Medium stable manure is used and watered at the time of unloading—in fact Mr. Tunney likes to get the maximum in at this time. To the 18 tons normally used he adds 1 ton of Shirley M at the time of stacking, which he does when the temperature reaches 160° F. at about 18″ from the floor. This is usually on the second day. During the next four days he does two turns, the timing being determined again by temperature and also appearance. On the next day he shakes out preparatory to filling the trays, using a D.L.P. turner.

The trays used are larger than average being about eight sq. ft. in area and to handle them a very efficient fork lift has been devised. This attaches to the rear of a Fordson Major tractor and carries them up to 8/9 high on a pallet to the peak-heat house, later to the growing houses and for any other moving operation.

Arrangement of trays in Peak Heat House

In the peak-heat house the trays are separated on stacking by 3″ wooden blocks at the four corners. The time spent here varies from 72—96 hours, sometimes as short as 60 hours. Heat may be used until the beds reach 120-122° F. Considerable ammonia is released during this period and for up to 36-48 hours while the bed temperatures increase but never exceed 130-140° F. From this

time until the end only internal movement of air is used. He uses a Shirley Oxygen Indicator and learns the condition of his compost from this. The operation is very simple. The rubber tube is passed through a small hole in the wall on to the nearest tray. The tests—often numbering five a day—are taken by the instrument outside and consequently at no time is it necessary to open the door of the peak-heat house. Mr. Tunney has proved by many tests that his air circulation within the house is excellent and that he can therefore take his readings from any given point with confidence in their accuracy. Opening the door—movement of a man within the house also—can affect the amount of oxygen in the room. The readings follow this pattern:—

Day 1. Temperature up to 120° F.
2. Oxygen reading 18%.
3. ,, ,, 14%.
4. ,, ,, 12%.

The percentage of oxygen decreases as the temperature falls and at 12% the release of ammonia has ceased. There then follows a quick heat up to 140° F. for the "kill", when with good ventilation the temperature falls and the house is cleared of ammonia and carbon dioxide.

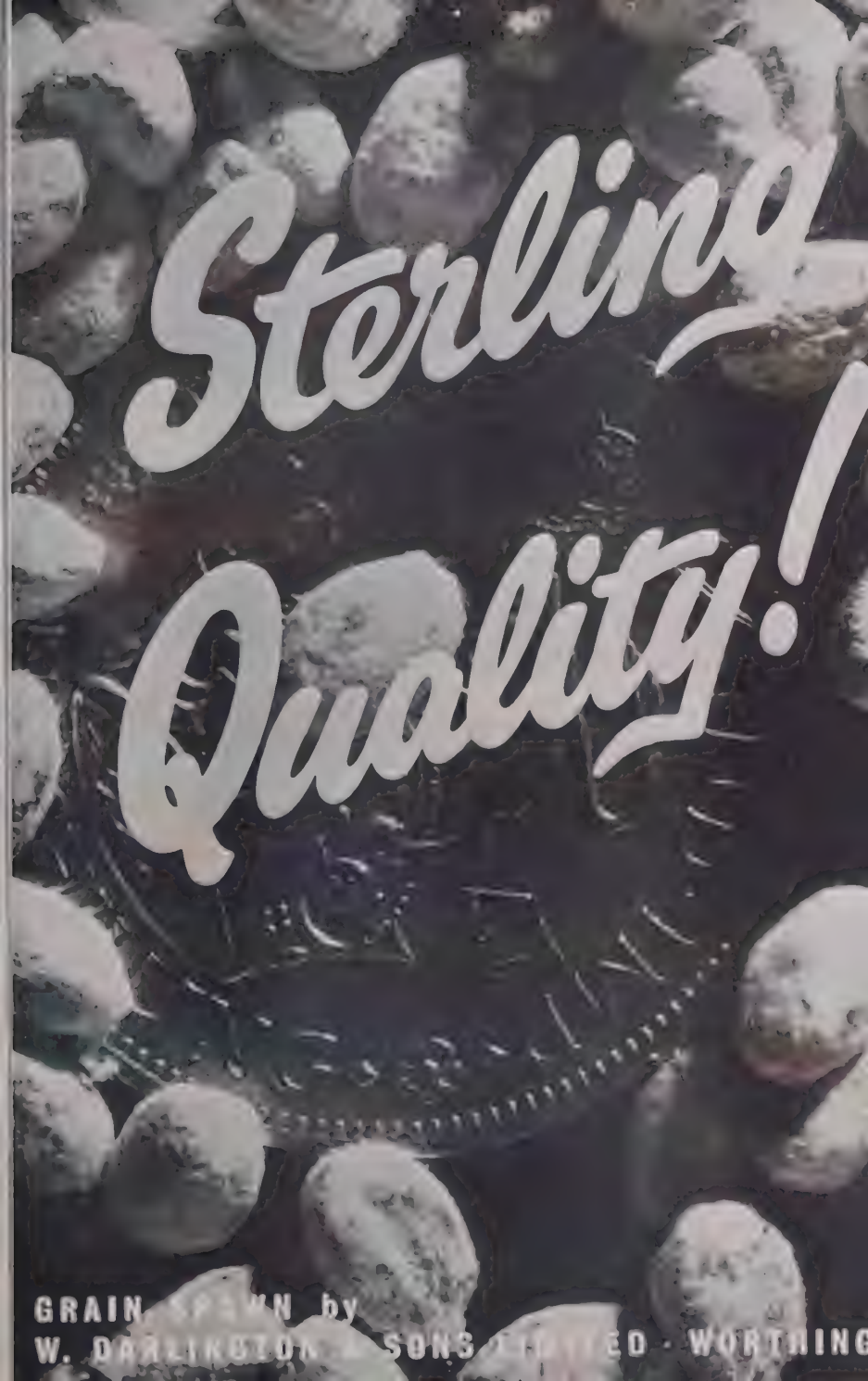
Owing to the three weekly cycle being used it is possible to use the same house for spawn run. So on cooling, Sinden Grain Spawn, at the rate of 1 carton to 24 sq. ft., is mixed in as thoroughly as possible by hand. Incidentally during the spawn run the oxygen reading is a fairly steady 18%.

Casing is done on the seventh or eighth day with a mixture of Somerset peat and $\frac{1}{4}$" to dust chalk, to a depth of $1\frac{1}{4}$". Both peat and chalk are bought in bulk and after wetting are mixed in a concrete mixer and fed into boxes. This helps accurate casing as two of these are used to each tray. On the fourteenth day the trays are moved to the growing house. As the buildings are not suited for a high temperature cook-out they are chemically sterilised by spraying the day before stacking. The trays are open stacked 9" apart—the length of the bricks used lengthwise at each corner.

Layout for mixing chalk and peat

This arrangement gives a similar appearance to shelves running the length of the house and in Mr. Tunney's opinion, more efficient air movement control is possible than with the usual brick laying method.

Picking commences on the twenty-first day after casing and continues for 46 days. Grading is done at the time of picking—buttons, cups, open cups and flats. Unless he can get at least 1/- per lb. he does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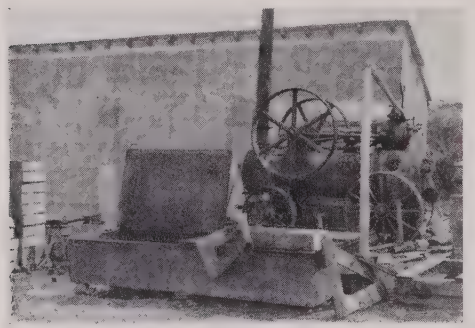
not pack stalks. So far there has been no pre-packing except for his wayside stand. Supplementing personal attendance at the stand is a slot machine for delivering half pound bags. Being on one of the main roads to the coast this trade is very useful, especially during the season.



Locomotive provides steam for peak heat house - rear - and tray sterilising tank shown in foreground

The maintained growing temperature is 58-60° F., heating being done bymeans of a coal-fired boiler. If humidity becomes too low steam may be used to correct but always very gently and with an eye on the thermometer. The quality of the mushrooms is first-class.

To obtain consistently such good crops is obviously due to good growing techniques and " know how " and not to any one individual reason. However, it is possible to isolate a few of the methods which are not common to all growers nor according to the " book ". For example, the compost is obviously very rich and it is produced under very rigid control, especially during the conditioning and peak-heat process. The ventilation and air movement is first-class. By drawing air into the house, instead of the usual extracting, clean fly free air is introduced and there is better control of it. The method of extraction is most efficient and air movement over the bed surface is maintained. As flies do not fly against the air stream this method also helps prevent their entry into the houses. Hygiene generally is good—even to the spraying of paths, roadways and surrounds with sodium chlorate to kill grass and weeds.

There is also the question of labour. Mr. Stay has never used imported help and he speaks very highly of his local staff. It could be of course that the confidence he places in them is reciprocated and they respond with maximum effort.

As usual with many growers, ideas for further improvement are always developing in the minds of Mr. Stay and Mr. Tunney and I am sure that when proven a further increase in productivity will result.

Calypso

PEN AND PAPER

To make the public mushroom-wise
This verse, as one might well surmise,
Appeals to every grower, large or small,
Their wives and children, short or tall,
To leave, alas, no stone unturned,
By having midnight oil so burned
In writing letters to the Press
Until the weight of mushroom stress
In prose or verse, in song or carol,
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First of all, fermentation goes ahead at a faster rate. Composting takes less time and the finished product is ready earlier.

Secondly, you have greater assurance that your crop will be free of pests and disease. The higher temperature either kills off the pests inside the heap or drives them to the surface, where they can be dealt with by insecticides. High temperatures during fermentation are particularly vital in preventing disease such as Vert-de-gris, of which there is special danger when composting during the winter months.

More nourishment

If you use Racing Stable manure, or other manure in which excess straw is present, the use of Adco "M" is strongly advised. The fermentation of this type of manure takes place more rapidly and effectively when Adco "M" is added. You get a more thorough breakdown of the strawy material, which then becomes available as food for the growing spawn. So your compost provides more nourishment for the mushrooms, and you get a bigger crop.

Better spawn run

Adco "M" produces a good quality compost of even texture. It provides an ideal medium for spawn run and helps to avoid greasy conditions, lack of aeration, and over wet compost – all of which delay mycelium growth. The spawn is able to make more rapid use of the food provided. It establishes itself more quickly and this is again a great help in preventing diseases and weed fungi. The faster the spawn grows and fills the compost the less likelihood is there of disease and weed fungi becoming serious competitors. A quick spawn growth also gives a quicker ultimate production.

You can have freedom from uncertainty in the composting process – by using Adco "M". It will pay you hands down. Adco "M" is specially formulated as a result of years of experiment, for the specific purpose of making mushroom compost. It can be used for composting with straw alone, if you wish. Or it can be used to compensate for variations in the quality and texture of your manure supply. Adco "M" provides the way to better mushroom compost every time.

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223. From July onwards untrained but optimistic salesboys have displayed wild mushrooms up and down the countryside. This early invasion is probably explained by the alternations of sun and rain which have characterised this period. In the Midlands one wholesaler alone was reported to have received 2,000 six pound baskets of " wilds " on one day. It looks as if the " wild " chaps have publicity equal to ours—their retail price is the same as ours, which I think is a new feature. Or has **our** publicity helped them? If so we " cultivated " types should plug our superiority(?), stressing perhaps the safety of our product.

224. Highly scientific, erudite and theoretically valuable as the Tschierpe carbon dioxide articles doubtless are, it is beyond dispute that they are quite useless to the commercial grower—the main supporter of the *Bulletin*. This is no doubt the precise reason for their inclusion. Please, Editorial Board, re-read Pinhead 220 if you can bring yourselves to it. If you persist in publishing this sort of thing our Bulletin will become as unreadable as is, according to my information, that—er—well . . . .discretion the better part of valour, etc.

225. Re Palfrey ; Bull. 128, page 319. Private enterprise with competition—yes, why not? Live and let live—yes, why not? If private enterprise means non-co-operation what are we doing with an Association? Cannot private enterprise co-operatively safeguard itself? Shouldn't it endeavour to do so when a point of at-or-below-cost-of-production is reached? A grower down on his luck should go out, says Ernest. Let Ernest grow 1 lb. per sq. ft. when everyone else is growing 2 lb. He's down on his luck, prices are low, he's a poor grower and poor in pocket. He's inefficient and should go out. But let him do badly while all other growers are doing badly. Prices are up, he makes a profit, he's a good grower, he's efficient. If one grower does badly and should be thrown out, all others doing equally badly should be thrown out. But why—when they're all making money! Is it unreasonable that everyone should try to make a profit, even if so-called efficiency produces bumper crops and causes gluts? As I've said before there's efficiency in production which is meaningless if there's no efficiency in marketing, in making supply fit closely to demand. If there was a much bigger demand we'd all want to produce more to meet it. If there's too little demand shouldn't we produce (or market) less? Where is our logic? And yours, Ernest? . . . and don't plaster the next Bulletin with economics!

226. How many of those who use dried blood in any form have ever asked or even thought whether there might be variations in the product? We assume dried blood is dried blood and that's all there is to it. Not so. I have it on authority that blood from, for instance, pigs is not the same as blood from cows or horses or sheep. And why, when you come to think of it, should it be? Pig blood can cause a greasy compost, I'm told. (I seem to have heard the same about pig

manure). We have to take blood from the abattoirs ; they may have a session of killing pigs, cattle or sheep. It's probably unlikely they kill all three at the same time, so we may have a preponderance of any one in a given batch of dried blood, or compound using D.B. as a base. It's therefore highly improbable that we get a proper *balanced* mixture of the three, even if we or our scientists knew what a balanced mixture was. Indeed it's 100-1 no scientist has ever done any work on it, or perhaps even thought of it. It's 1,000-1 no D.B. purveyor has ever asked our scientists what mixture we should have. I am assured there are seasonal killings of the various animals. At Brayton we have long been users of D.B. in various forms and formulae, and there is evidence of different results coinciding with the seasonal killings. Just another little problem for us. And for Research, when it emerges triumphantly from the sciarid and mycogone stage.

227. In the interest of production efficiency—so we are pleased to think— we now keep our boilers going throughout the summer. Gone are the days when we could say in May, " Thank goodness we've finished with heating problems for the next four months." More efficiency—more headaches.

228. Summer—no evaporation. No evaporation—no mushrooms. Moisture can only be taken from the casing by moisture-holding mushrooms (of which there are none!) or by using a dry compost as blotting paper. But . . . dry compost—no mushrooms. So what?

229. Heresy again. With production at danger point it's no business of the MGA or the grower to help anyone to expand or new men to start. It's up to the expander or the new man to work his own way up ; he cannot reasonably expect his competitors to help him to be a bigger competitor. But . . . BUT . . . in my view there is every justification for any or every grower and the MGA to help an existing grower out of any cultivation troubles which may have befallen him, for to bring this sufferer back to normal would only be maintaining a status quo, and I take it no one would wish to see a genuine grower sink under a load of unnatural misfortune (as opposed to financial or managerial laziness or carelessness, of course), even though if he were a large grower his short deliveries would tend to raise our own prices. Heresy? Humanity? Closed-shop? Trade Protection? What you like.

230. Major Dredge would do well to heed the many vapid and vacuous statements ventilated through the open-minded (and now hairless) Pinhead " top ". By so doing he would know that after a period of 18 months or more at below 1.5 we suddenly jumped to nearly 2.5, which has now been held for nigh on a year. We did not suddenly push the air " in at the top ". In fact no cultural change was made. The cause of the improvement was, I believe, in a basic material over which we had and have no control. Keep blowing in at the top, Major ; it looks like you're doing us some good too!

M. C. LUXMOORE *protests against*

PINHEAD 213

As an ardent fan of *The Bulletin* I am accustomed to read its pages from cover to cover and, as a delightful " bon bouche ", digest Pinheads before disturbing my equanimity with numerical profundities, Latin nomenclature, and reminders of my inability to remember elementary chemical formulae.

In July no such enchantment followed this regular procedure and Pinhead Pepys has indeed overtaxed my gentle disposition.

In short his pinhead 213 is a perfect BURUP—which may indicate Large Scale Ventilation in Denmark but also is perfectly good Anglo-Saxon for this ungracious and ill-advised comment.

Can it be that hard times have changed him into a M.U.G. (Mixed-up Grower), indifferent to free advice and scornful of willing help dispensed without reference to his cheque book?

If so it is indeed time he became one of The Top People—gave up the *Yorkshire Post* and became one of the readers of *The Times* to whom, as everyone knows, courtesy and restraint are of paramount importance.

To be brief, we hastened North when we heard our aid was being enlisted in diagnosing the cause of some rather indifferent crops in Yorkshire, and our opinion that poor quality straw was the answer to the conundrum was proffered knowing full well that it would be rejected, and for that matter any other explanation that might be advanced.

At least (incurring considerable expense ourselves in time and petrol) we felt elated at having immediately answered a fellow mushroom grower's call for assistance.

We were, as it happened, in an excellent position to give this opinion (*a*) because we ourselves had suffered in a like manner, (*b*) because we were Synthetic Growers at the time and our Activators never vary, (*c*) because the excretory system of the horse is unlikely to go " hay-wire " for as long as two whole years, and (*d*) because the stacks we saw resembled nothing as much as wet, green sea-weed.

Needless to say P.P. was at pains to raise subsequent crops to higher and more adequate yields and this was achieved as soon as the fresh harvested straw became available, and without further ado first flushes of $1\frac{1}{4}$ lb. were soon in evidence.

Concurrently it was advanced in a Pinhead that the Deity had treated the Midlands to a previous harvest of wet and soggy proportions, and could The Midlands (Yorkshire in particular) trust the Almighty not to repeat these calamitous conditions.

Pinhead No. 216 now sees a vastly improved position. Purveyors of high-powered motor cars, suitable for even equatorial conditions, gather on the door step and are rebuffed for offering limousines that the rich natives cherish, and to which I cannot aspire, save secondhand.

How has this change transpired?

By raising a series of poor crops to good ones and, although no doubt he will refute it, not by raising good crops to super ones.

Glimpse not a future Eldorado.

Science has taught us how to speed our crops, and grain spawn has enabled both speed and reliability to go hand in hand. It has taught us to make much better use of our space. It has taught us how to control disease, make a quicker compost, in fact to be 100% more efficient.

But one thing it has not done is to teach us how to increase a 3 lb. crop to a 4 lb. crop.

In fact the maximum of 30 years ago is the maximum of to-day, but it is achieved in much shorter time.

Dear P.P., write and tell me when you are converting three pounders to four pounders, but if the $1\frac{1}{2}$ lb. turn up 'phone for one of the Bottom People who read *The News of the World*. BURUP. M.U.G. No consultation fee asked. We will once again immediately set motor to Yorkshire and inform you how to raise medium yields to good ones, but never good ones to superb.

JARROW MUSHROOM FARM COURT CASE SETTLED

In a recent case in the High Court, a claim for damages brought by Mr. J. Hunter Carr, Jarrow Mushroom Farm, against the Northern Gas Board was settled out of court.

Mr. S. R. Hughes gave evidence for the Plaintiff. Dr. W. F. Bewley and Dr. R. L. Edwards attend the court to advise the Defendants but were not called as witnesses because the case was settled before their evidence was required.

A report on the Jarrow farm appeared in the *MGA Bulletin* in 1952. Mr. Carr claimed in the action that his mushroom crops and spawn were damaged by smoke, fumes, etc. from a new gas-making plant installed at Jarrow Gas Works in 1951. R.L.E.

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PART V (3) *continued from August Bulletin*

STUDIES ON THE INFLUENCE OF CARBON DIOXIDE ON THE CULTIVATED MUSHROOM

By **Dr. H. J. Tschierpe**
Institut für Gemüsebau der Technischen Universität Berlin Direktor Prof Dr. H. Riethus

(*The original paper was published in "Die Gartenbauwissenschaft 24, 1, 18-75, 1959*)

FIG. 23: Sporophore at the beginning of the treatment.

FIG. 24: After 4 days growth in an airstream with 10 volume per cent CO_2 (Exp. II B).

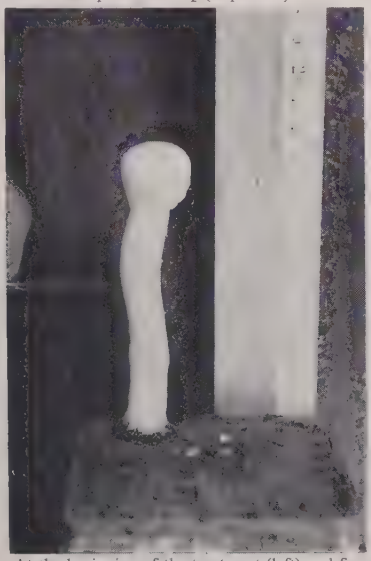

FIG. 25: Sporophore of the experiment II B, set 1; At the beginning of the treatment (left) and five days later (right).

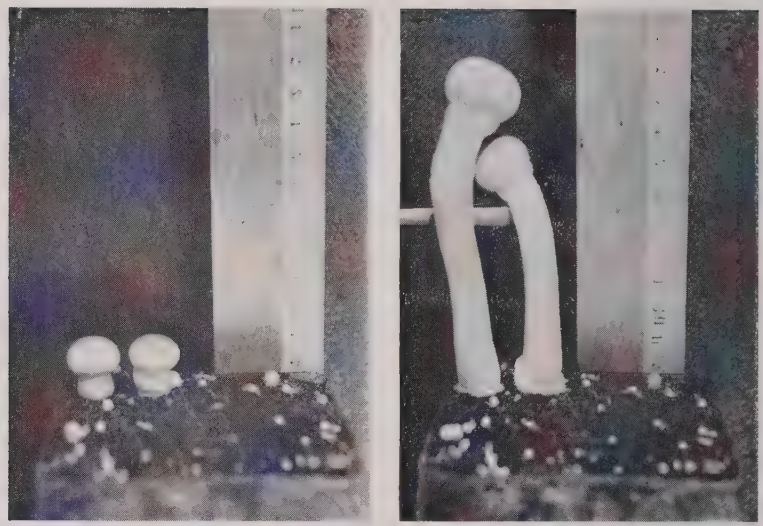

FIG. 26: Sporophores of the experiment II B, set 2; they grew under accumulation conditions and at the end of the treatment had exactly the same shape as the fruitbodies which were continuously ventilated with air with 10 per cent CO_2 (see figure 25).

Experiment II C

Instead of air with 10 per cent CO_2 in this experiment air with 5 per cent CO_2 was used for ventilation in one set. Two further sets were the same as in experiment II B (accumulation and ventilation with CO_2-free air). The direction of the air stream in this and in the further experiments were the same as in experiment II B. The experiment lasted five days. Figure 27 shows sporophores grown in an atmosphere with 5 per cent CO_2, table 11 the data of the fruitbodies.

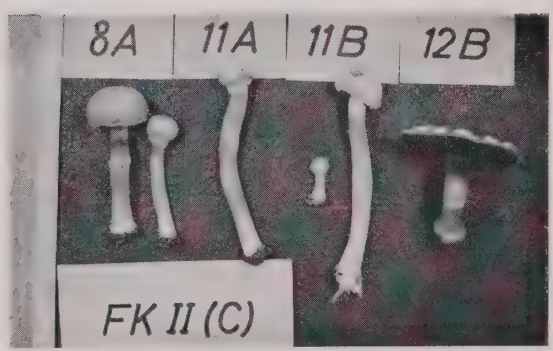

FIG. 27: Sporophores of experiment II C; grown in air with 5 volume per cent CO_2.

TABLE 11

Sporophore data of experiment II C

Mushroom No.	Total length in mm.	Cap diam. in mm.	Stipe diam. at the annulus in mm.	Stipe diam. at the base in mm.	Total weight in g.	Cap weight in g.
1	90	30	12	13	11.12	4.65
2	80	20	7	11	4.37	1.08
3	120	24	10	12	10.25	1.42
4	30	11	11	8	—	—
5	132	28	9	13	8.19	1.60
6	70	70	12	15	22.29	14.60

One sporophore in this treatment has a normal shape. This mushroom was already very large when the treatment began. Because of the irreversibility of growth the morphogenic influence of CO_2 could not be effective in this case. The same applied to the mushroom shown on the left. This was, however, smaller at the beginning of the treatment.

Experiment II D

Three sets were used in this experiment:

1. Four jars were ventilated for five days with an airstream, artificially enriched with 2 per cent CO_2.
2. Four jars were placed under accumulation conditions.
3. Four jars were ventilated with CO_2-free air.

After five days the mushrooms in the 2 per cent CO_2-stream showed the same (usual) malformations as those fruitbodies grown under accumulation conditions. The sporophores in the containers which were ventilated with CO_2-free air had already sporulated.

Then malformed mushrooms were not picked but remained on the " bed " and the containers were placed, open, in the normal room air. 6 days later the caps of all the sporophores had opened and sporulated (see figure 28 and 29). Sporophores left under the first conditions (CO_2-stream or accumulation) did not open, no sporulation took place, and the fruitbodies died. This experiment was repeated twice with the same results.

Experiment II E

Four jars were ventilated for five days with an airstream of 1.5 volume per cent CO_2-content.

At this concentration an obvious tendency to a normal shaped mushroom could be observed. Though there was still an abnormally long stipe, the cap opened more than at higher CO_2-concentrations and the veil opened normally.

Sporophores of the experiment II D, grown in an airstream with 2 volume per cent CO_2.
Left: At beginning of treatment. Centre: After 5 days treatment. Right: After 6 further days in room air.
(CO_2-content of room air 0.04 volume per cent.)

Fig. 29: Sporophores under accumulation conditions.
Left: At beginning of treatment.
Centre: After 3 days treatment.
Right: After 5 further days in room air.

Experiment II F

Four jars were ventilated for five days with an airstream of 1.0 volume per cent CO_2-content.

At this concentration also an obvious tendency to normal shaped fruitbodies could be observed. Sporophores, whose cap at the beginning of the treatment had a diameter of 1.0 to 1.2 cm. opened and some produced spores. The stipe was still abnormally long.

Experiment II G

Four jars were ventilated for five days with an airstream of 0.5 volume per cent CO_2-content.

As under the influence of high CO_2-concentrations here also the stipe elongated abnormally, but there was a tendency to normal shaped caps, and spores were developed in some cases. The ratio cap: stipe weight of the sporophores grown in an atmosphere with 0.5 volume per cent CO_2 was on the average about 1 : 3. The ratio was about 2 : 1 for the sporophores grown in CO_2-free air (see Fig. 30 and table 12).

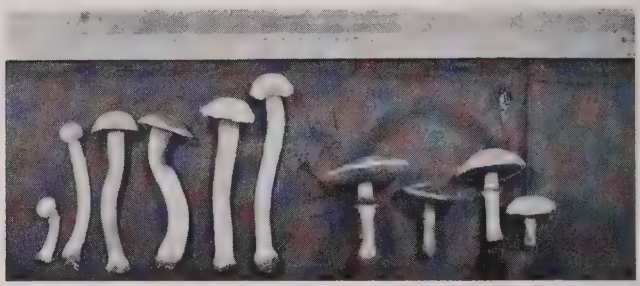

FIG. 30: Sporophores of experiment II G.
Left: After five days ventilation with air artificially enriched with 0.5 volume per cent.
Right: Four sporophores grown in CO_2-free air.

TABLE 12

Mushroom No.	Total length in mm.	Cap diam. in mm.	Stipe diam. at the base in mm.	Stipe diam. at the annulus inmm.	Total weight in g.	Cap weight in g.
1	35	11	6	5	0.93	0.30
2	75	12	8	6.5	1.68	0.22
3	87	23	14	8	4.42	1.13
4	23	29	14	10	4.93	1.28
5	92	29	12	10	6.01	1.60
6	103	22	14	8	5.71	1.24
7	25	26	5	6	1.69	1.32
8	47	36	8	7	3.84	2.69
9	50	46	8	7	7.07	5.35
10	37	31	6	5	2.21	1.48

Experiment II H

The CO_2-content of the air used for ventilation was reduced to 0.3 volume per cent.

Under these conditions also the stipe grew to an abnormal length, but the caps opened normally and sporulated. The sporophores grew to the " gigantic " proportions as already observed by Mader and also shown in figure 19. Figure 31 shows fruitbodies of this experiment.

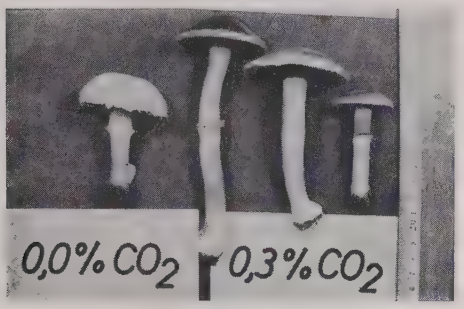

FIG. 31: Sporophores, grown in CO_2-free air and in air with 0.3 volume per cent carbon dioxide.

TABLE 13

Date of sporophores grown for five days in an airstream with 0.3% carbon dioxide content

Mushroom No.	Total length in mm.	Cap diam. in mm.	Stipe diam. at the base in mm.	Stipe diam. at the annulus in mm.	Total weight in g.	Cap weight in g.
1	125	64	15	15	25.51	12.34
2	104	50	15	14	17.35	7.56
3	80	42	12	10	11.13	5.68
4	152	54	13	20	19.12	6.99
5	107	65	14	13	23.27	13.12
6	65	38	10	12	6.55	3.22
7	142	44	13	16	15.48	4.22
8	97	48	12	14	13.59	6.42

Experiment II J

Four jars with sporophores were ventilated for five days with an airstream of 0.2% CO_2-content. There was a slight tendency to an abnormal stipe elongation, but not so evident as in an airstream with 0.3% carbon dioxide. Cap formation and sporulation were normal.

Experiment II K

Four jars were ventilated for five days with an airstream of 0.1 per cent CO_2. Fruitbody development was normal.

4. Discussion

The experiments described support **Lambert's** result of 1933 and prove a morphogenic and physiological influence of carbon dioxide on mushroom fruitbodies. Even concentrations which were not detectable with the methods applied in earlier experiments of other authors have a morphogenic influence. In the experiments carried out here the influence of carbon dioxide from commercial cylinders was the same as the influence of CO_2 from the metabolism of the fungus itself and from the respiration of the compost. Statements according to which other volatile metabolic products as well as CO_2 have a morphogenic influence (**Mader,** 1943; **Stoller,** 1945; **Lambert,** 1958) could not be confirmed in the experiments described. In CO_2-poor air normal fruitbodies always developed, whilst in every case, in air with high CO_2-concentrations, malformed sporophores appeared. The extent of the deformation depends on the absolute CO_2-concentration and on the stage of growth of the sporophore at the beginning of the experiment. The deformation made its appearance in a forced elongation of the stipe and in a thickening at the base. At the same time the cap growth is retarded and no sporulation takes place. The results of Mader cited in the introduction (Series 4, experiment C, tray a) could therefore be explained as a mere CO_2-effect. The fruitbodies with the " gigantic proportions " were probably the largest at the beginning of the experiment. Placed into a closed chamber, wherein the CO_2-content slowly increased (to about 0.3 per cent) the " gigantic " mushrooms developed. Smaller mushrooms, which would need a longer time for developing to " ready " mushrooms, grew in air in which the CO_2-content had in the meantime increased (e.g., to more than 1.0 per cent) and showed the typical appearance of sporophores in high CO_2-concentrations: tiny caps, onion-like stipes.

Given the same CO_2-concentration and the same size of the sporophores at the beginning of the treatment, the deformations are always the same. A suitable criterion seems to be in the cap : stipe-weight ratio. In CO_2-free or CO_2-poor air this ratio for sporulating sporophores is about 2 : 1. With increasing CO_2-concentrations the ratio changes up to 1 : 10. For each concentration there seems to exist a fixed ratio. The determination of these ratios for all CO_2-concentrations is only possible in very big experiments and could not be carried out in our laboratory experiments. The data mentioned, however, show that sporulating normal sporophores have a cap : stipe-weight ratio of about 2 : 1. The more this ratio is shifted at the expense of the cap, the higher is the CO_2-concentration in the air surrounding the sporophore. It seems not impossible to us that mushroom fruitbodies could be used in this way for a rough " biological " method of measuring CO_2.

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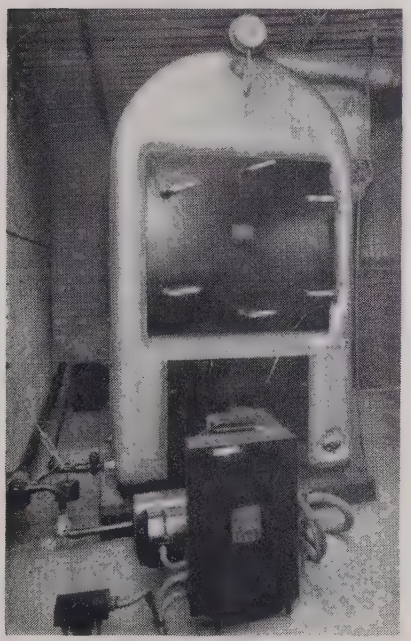

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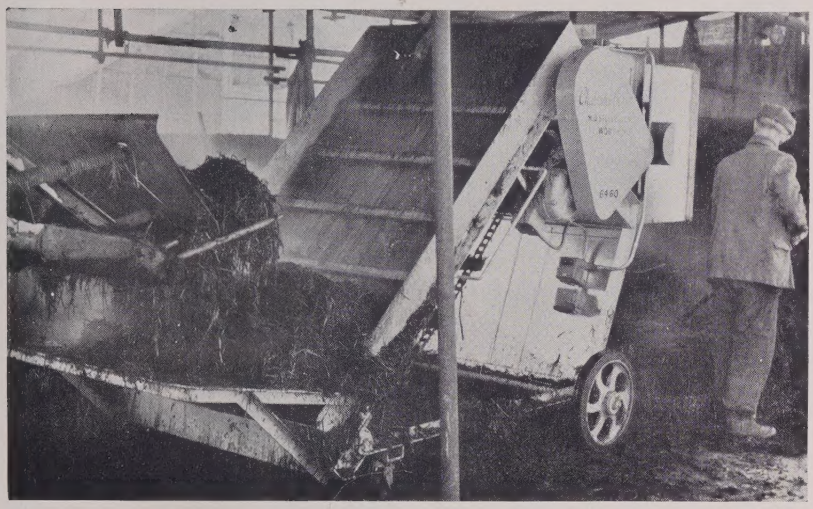

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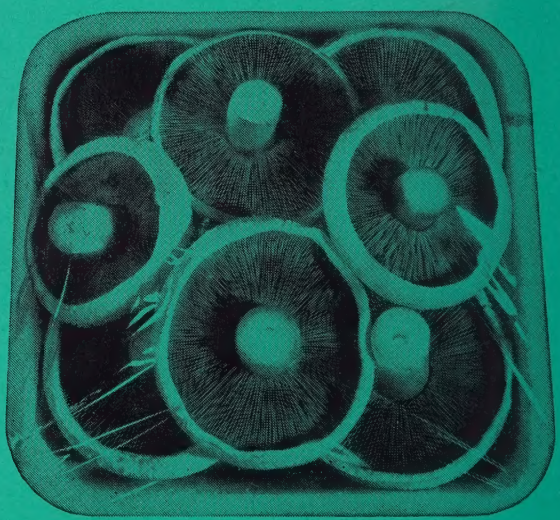

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